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The Government Expenditure Efficiency towards the Human Development

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Abstract

In this paper, we investigate the efficiency level of government expenditure per capita in health and education sectors and transfers and subsidies in 81 countries towards the human development in the respective countries by using Data Envelopment Analysis (DEA) approach during 2006-2010. We found there are countries that always be positioned in the efficient frontier during the sample period, namely: Armenia, Australia, Bangladesh, Chile, Georgia, Japan, Korea Republic, Lao PDR, Madagascar, Niger, Norway, Philippines, Sierra Leone, Singapore, US, and Zambia. Nevertheless, only Singapore and Zambia succeed to maintain positive improvements among countries that are listed in the efficient frontiers.

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1. Introduction

There has been a debate for decades between Keynesian and Neo-Classical economists regarding the importance of government intervention to the market. No less than the Nobel Prize winner, James Buchanan, argued that government involvement could make things worse since public choices might become inefficient in under-developed private market (Buchanan, 1975; Buchanan and Musgrave, 1999). In addition, Tanzi (2005) stated that government involvement often created public monopolies that crowded out private participation. He suggests that the government is supposed to correct the mistakes made by the market, or to compensate for its shortcomings, and not to replace the market.

However, many studies shown that government expenditures, especially in health and education sectors, do make a positive contribution to the public goals. Gupta et. al. (1998) mentioned that government expenditures on health and education sectors could bring positive effects on human capital that, at the end, boost economic growth while promoting equity and reducing poverty. Furthermore, Doryan (2001) explained that when the government has used the benefit of economic growth to finance basic health care and access to education for all, it will bring double benefit to the poor; they are healthier and better educated, and they will increase their consumption. Particularly on government expenditure on health sector, Razmi et. al. (2012) explained that increased health expenditure will improve labor productivity and increase the supply of work force and, as the results, increase productivity and economic growth.

Nevertheless, empirical results might find varieties on the significance of the sectorial expenditures. While agreed on the positive effects of government expenditures towards poverty reduction, Asghar et. al. (2012) found that the impact of government expenditures in health sector was insignificant in Pakistan. Suescún (2007) found that infrastructure spending dominates other forms of public spending (education, health, government consumption and transfers to low-wealth households) in terms of sizable positive effects on growth performance, welfare, human development and social progress in the Latin American countries. We suppose these varieties come from the efficiency level of the government expenditure usage. It appears that in countries which are rated as very corrupt or are rated to have a very ineffective bureaucracy; public health spending at the margin will be ineffective. Similarly, increasing public spending on primary education is likely to be more effective in raising primary education attainment in countries with good governance (Rajkumar and Swaroop, 2007).

In this paper, we investigate the efficiency level of government expenditure per capita in health and education sectors and transfers and subsidies in 81 countries towards the human development in the respective countries by using Data Envelopment Analysis (DEA) approach ranged from 2006 to 2010. While offering broader dimensions than a mere economic indicators, to our knowledge, human development has not been used as the targeted output of the government in the previous studies. The rest of the paper is organized as follows: Section 2 will discuss about DEA method and Malmquist index. Data and the methodology being used in this study will be explained in Section 3. The result of comparative efficiencies will be analyzed in section 4. And lastly, concluding remarks will appear in section 5.

2. Literature Review

2.1. Variable Return Scale (VRS) DEA

Data envelopment analysis (DEA) is a non-parametric mathematical programming to estimate the inefficiency of outputs given inputs and vice versa. This method constructs an envelopment frontier over the data points such that all observed points lie on or below the production frontier (Coelli, 1996). This method, however, does not generate general relationship and only rely on the input-output ratio optimization. It firstly introduced by Farrell (1957) and then extended by Banker, Charnes, and Cooper (1984) to accommodate when the decision making units (DMUs) are operating at the non-optimal scale environment. These non-optimal scales might be caused by imperfect competition, constraint on resources, etc.

Coelli (1996) comprehensively discussed about DEA method. Assume there is data on K inputs and M outputs for each of N DMU. For the i -th DMU these are represented by the vector x_i and y_i , respectively. The $K \times N$ input matrix, X , and the $M \times N$ output matrix, Y , represent the data of all N . Then the DMU's problem is

$$\begin{aligned} & \max_{\phi, \lambda} \phi, \\ & \text{St} \\ & -\phi y_i + Y\lambda \geq 0, \\ & x_i - X\lambda \geq 0, \\ & N1'\lambda = 1, \\ & \lambda \geq 0 \end{aligned} \tag{1}$$

Where ϕ is a scalar and λ is a $N \times 1$ vector of constants. $N1$ is a $N \times 1$ vector of ones. This approach forms a convex hull of intersecting planes which envelope the data points more tightly than the Constant Return Scales (CRS) conical hull, and thus provides technical efficiency scores which are greater than or equal to those obtained using CRS model. The value of ϕ obtained will be the efficiency score for the i -th DMU. It will satisfy $\phi \geq 1$, with a value of 1 indicating a point on the frontier, and hence a technically efficient DMU. The proportional increase in outputs that could be achieved by the i -th DMU with input quantities held constant denotes by $\phi - 1$, while $1/\phi$ defines the technical efficiency scores which varies between zero and one.

The CRS efficient frontier measures the maximum output-input slope from the original point, while VRS efficient frontier sorts the slopes starting from DMU which has minimum input. In figure 1, both DMU C and D are efficient in CRS and VRS method. DMU A, B, and E are considered efficient in VRS method but not in CRS method.

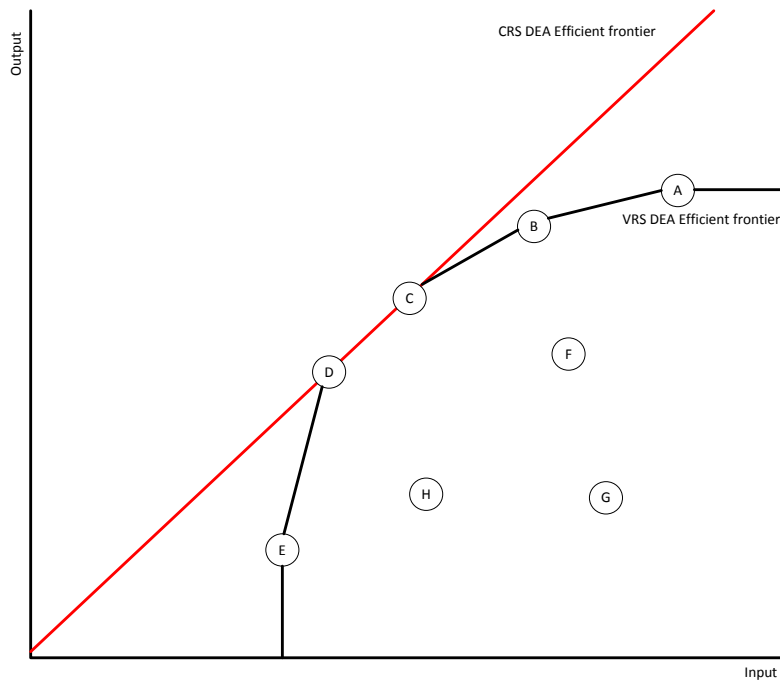


Figure 1 Comparison of Efficient frontier between CRS and VRS method

2.2. Malmquist Index

It is interesting to measure how much the efficiency improvement in aggregate has been obtained in a particular period. The measurement is possible by using Malmquist index – an extension of DEA which compares the technical efficiency at $t+1$ and t . Fare et. al. (1994) specifies Malmquist index as:

$$m_0(y_{t+1}, x_{t+1}, y_t, x_t) = \left[\frac{d_0^t(x_{t+1}, y_{t+1})}{d_0^t(x_t, y_t)} \times \frac{d_0^{t+1}(x_{t+1}, y_{t+1})}{d_0^{t+1}(x_t, y_t)} \right] \quad (2)$$

Where

$$[d_0^t(x_t, y_t)]^{-1} = \max_{\phi, \lambda} \phi, \quad (3)$$

St

$$-\phi y_{it} + Y_t \lambda \geq 0,$$

$$x_{it} - X_t \lambda \geq 0,$$

$$\lambda \geq 0.$$

$$[d_0^{t+1}(x_{t+1}, y_{t+1})]^{-1} = \max_{\phi, \lambda} \phi, \quad (4)$$

St

$$-\phi y_{it+1} + Y_{t+1} \lambda \geq 0,$$

$$x_{it+1} - X_{t+1} \lambda \geq 0,$$

$$\lambda \geq 0.$$

$$[d_0^t(x_{t+1}, y_{t+1})]^{-1} = \max_{\phi, \lambda} \phi, \quad (5)$$

St

$$-\phi y_{it+1} + Y_t \lambda \geq 0,$$

$$x_{it+1} - X_t \lambda \geq 0,$$

$$\lambda \geq 0.$$

$$\begin{aligned}
[d_0^{t+1}(x_t, y_t)]^{-1} &= \max_{\phi, \lambda} \phi, \\
\text{St} \\
-\phi y_{it} + Y_{t+1} \lambda &\geq 0, \\
x_{it} - X_{t+1} \lambda &\geq 0, \\
\lambda &\geq 0
\end{aligned} \tag{6}$$

Basically, the malmquist index measures the productivity of the production point (x_{t+1}, y_{t+1}) relative to the production point (x_t, y_t) . An index value greater than one indicates positive improvement on efficiency.

3. Methodology

To our knowledge, there are several studies that measure the efficiency using DEA towards its objective output. Afonso and St.Aubyn (2004) measured the efficiency in education and health sectors in OECD countries. They used several inputs and outputs for both sectors, i.e. for education sector the inputs are expenditure per student, average class size, ratio of students to teaching staff, number of instruction hours and the use and availability of computers. The outputs are performance of 15-year-olds on the PISA reading, mathematics and science literacy scales. As for health sector, they used in-patient beds, medical technology indicators, and health employment for inputs while for outputs they used life expectancy and infant and maternal mortality data.

Herrera and Pang (2005) measured the efficiency of government spending in health and education sectors in developing countries. They used government spending per capita on education and health sector ranged from 1996 to 2002 as the inputs. Whereas for the outputs they used primary school enrollment (gross and net), secondary school enrollment (gross and net), literacy of youth, average years of school, first level complete, second level complete, and learning scores for education sector and life expectancy at birth, immunization (DPT and measles), and the disability-adjusted life expectancy (DALE) for health sector.

Afonso, Schuknecht, and Tanzi (2010) measured the efficiency of government expenditure on social spending towards income disparities in OECD countries during 1995-2000. They used public social spending as the input and gini coefficient as the output.

In this paper, we use three inputs that are controlled by the government, i.e. government expenditures per capita on education and health sectors and also on subsidies and other transfers. The data set is obtained from the World Bank data base, ranged from 2006-2010. To compare economic statistics across countries, the data must first be converted into a common currency. Unlike market exchange rates, PPP rates of exchange allow this conversion to take account of price differences between countries. In addition, we do extrapolation and interpolation to fill in some missing data in several countries.

We set the Human Development Index (HDI) as the government target output as we believe that this index is a better measure than a mere economic indicator, such as GDP growth. The HDI is a composite measure of health, education and income that was introduced in the first Human Development Report in 1990. The education component of the HDI is measured by mean of years of schooling for adults aged 25 years and expected years of schooling for children of school entering age. The health component is measured by life expectancy at birth. And the living standard is measured by GNI per capita (PPP). The scores for the three HDI dimension indices are then aggregated into a composite index using geometric mean.

We then compare the government expenditure efficiency of each country for each year in the analysis period by using VRS DEA. In addition, we also measure the improvement of the efficiency of each country by using Malmquist index method.

4. Results

During the sample period, there are several countries that were considered to be efficient in managing the government expenditure in order to maximize their HDI, namely: Armenia, Australia, Bangladesh, Chile, Georgia,

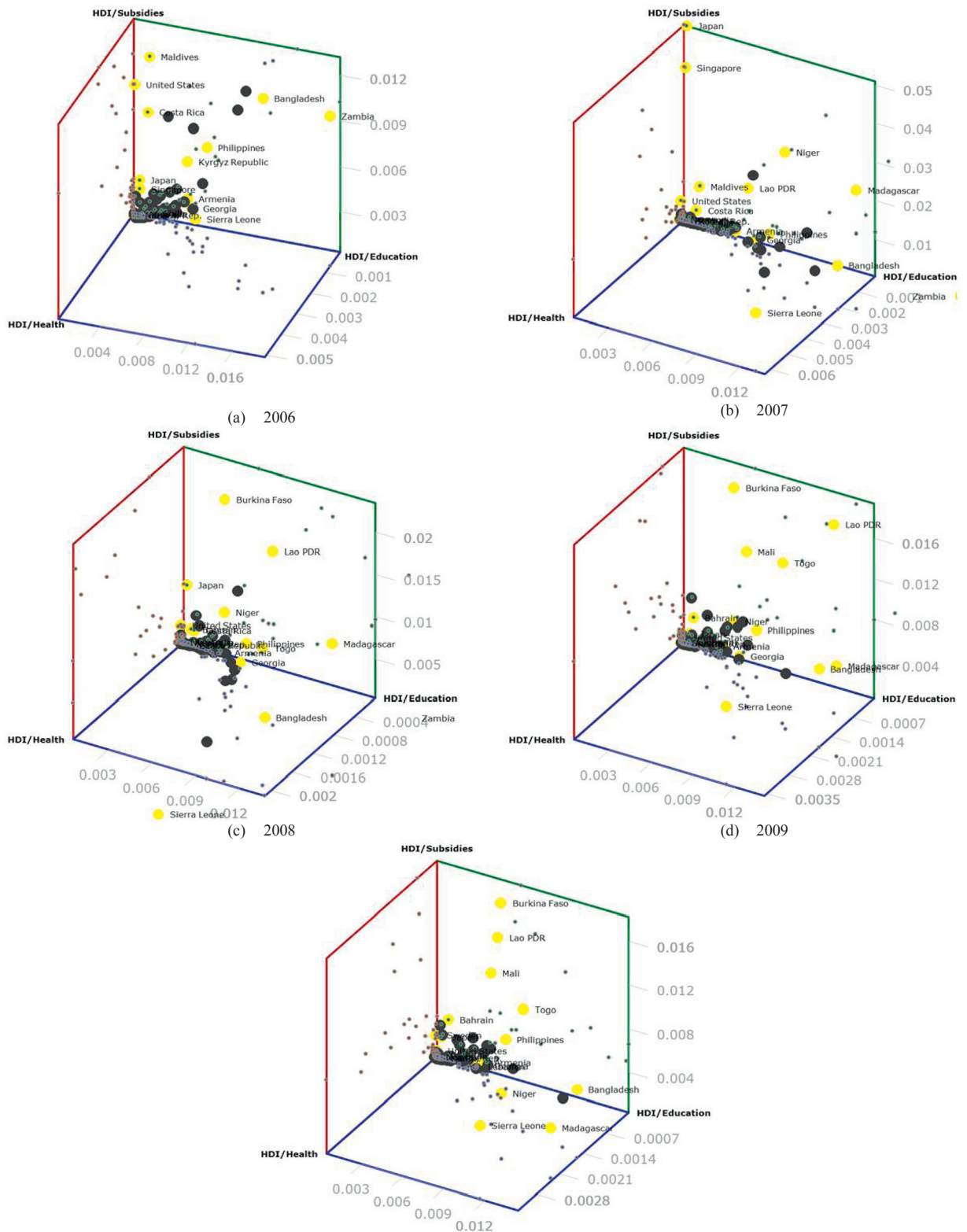


Figure 2 The distribution of output/input ratio in (a) 2006, (b) 2007, (c) 2008, (d) 2009, and (e) 2010

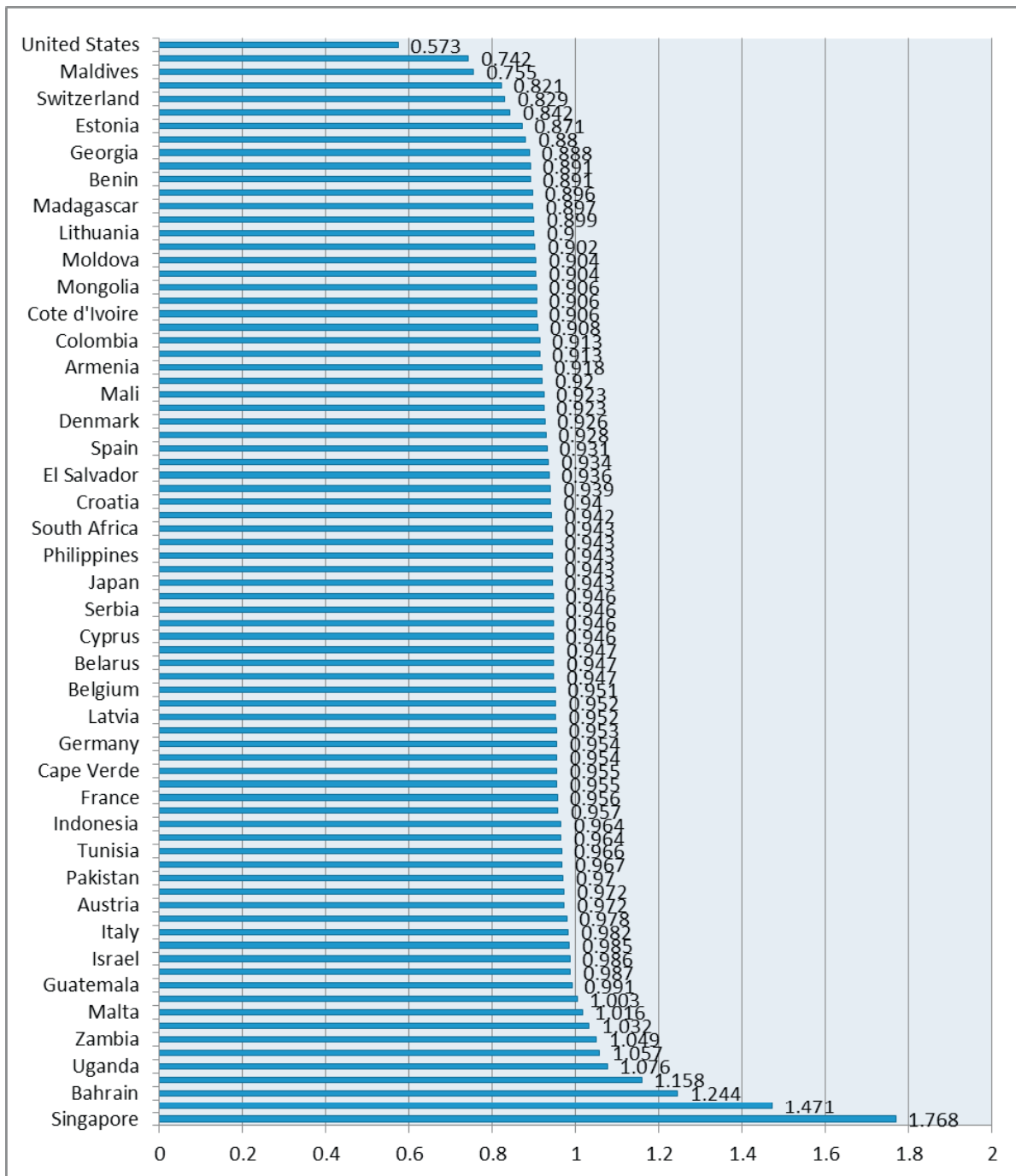


Figure 3 Malmquist index of improvement of government expenditure efficiencies during 2006-2010

Japan, Korea Republic, Lao PDR, Madagascar, Niger, Norway, Philippines, Sierra Leone, Singapore, US, and Zambia. Those countries were always shaping the convexity of the frontier in all periods. Bahrain, Burkina Faso, and Togo appeared to be inefficient in 2006 and 2007, but become efficient in the rest of the years. Mali started to shape the efficient frontier in 2009, while both Lebanon and Sweden followed in 2010. Kyrgyzstan was once positioned in the frontier in 2006, but then ceased to be efficient since 2007. While Maldives and Costa Rica were

became inefficient starting 2008 and 2009 respectively. Czech Republic appeared to be efficient in 2008, but then ceased in the next year.

Based on disaggregated output/input ratios, it seems that Sierra Leone and Zambia were superior in efficiency in health and education sectors respectively. The trends however toward different directions; every 1 USD spent on education per capita in Zambia contributed to 0.019 points of HDI in 2006 and increased to become 0.026 in 2010, on the other hand, the HDI-to-health-expenditure-per-capita ratio in Sierra Leone were deteriorated from 0.005 in 2006 to 0.003 in 2010. Niger excelled other countries in terms of HDI-to-subsidies-and-transfers-per-capita ratio in 2006. However its position was replaced by Japan in 2007, and Singapore from 2008 onwards.

Nevertheless, only Singapore and Zambia succeed to maintain positive improvements among countries that are listed in the efficient frontiers. Singapore even scored a fantastic Malmquist index, 1.768, which means that the HDI score was averagely improved about 76.8% each year, given the inputs. However, when we looked up the data, the HDI scores of Singapore were not improving so much. The improvement in Malmquist index was happened because the government of Singapore was drastically cut the subsidies and transfers to its people in 2007 while maintaining steady HDI scores. On contrary, even though still considered as efficient, the US government was significantly increasing its expenditure per capita –especially on health sectors and subsidies and transfers – while having stable HDI scores. This made the overall Malmquist index score for US very low.

5. Conclusion

We compared the government expenditure efficiency in 81 countries during 2006-2010 by using DEA method. We use government expenditures per capita on education and health sectors and also on subsidies and other transfers as the inputs and Human Development Index as the output. We found there are countries that always be positioned in the efficient frontier during the sample period, namely: Armenia, Australia, Bangladesh, Chile, Georgia, Japan, Korea Republic, Lao PDR, Madagascar, Niger, Norway, Philippines, Sierra Leone, Singapore, US, and Zambia. Nevertheless, only Singapore and Zambia succeed to maintain positive improvements among countries that are listed in the efficient frontiers.

For further study, it would be interesting to observe how efficiency of government expenditure could affect the human development progress. We suppose, it could partially explain the slow progress of the Millenium Development Goals proposed by UN. Another interesting topic is to figure the root cause of inefficiencies in many countries. This could be achieved by both quantitative – by finding the impact of suggested cause variables to the efficiency of government expenditures – and qualitative analysis – by doing a comparative study of government policies and the implementation system in benchmarked efficient countries.

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